The Defense-growth nexus: An application for the Israeli-Arab conflict

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THE DEFENCE-GROWTH NEXUS REVISITED: EVIDENCE FROM THE ISRAELI-ARAB CONFLICT

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Abstract

This paper revisits the defence-growth nexus for the rivals of the Israeli-Arab conflict over the last four decades. To this end, we utilize the Toda and Yamamoto (1995) causality test and the generalized variance decomposition. Contrary to the conventional wisdom and many earlier studies, we fail to detect any persistent adverse impact of military expenditures on economic growth. Our conclusions are kept intact even when we account for the possibility of endogenous structural breaks and during the post-1979 peace treaty period. Our findings imply insignificant peace dividends once the conflict is resolved and the military spending is cut to internationally acceptable standards.

Keywords: Growth, Middle East, Israeli-Arab conflict, Causality, Generalized Forecast Error Variance Decomposition
JEL Classification: H56, O53

INTRODUCTION

Economists have long debated how military spending affects economic growth and whether causality runs from defence to growth or vice versa. On one hand, causality, whether negatively or positively, can run from defence to economic growth; military spending, as other government expenditures, may impede economic growth by crowding-out private investment. Moreover, higher military spending results in distorted resource allocations, and the diversion of resources from productive activities to accumulation of armaments and maintenance of military forces. However, in his seminal work, Benoit (1978) asserted that for Least Developed Countries (LDCs), only a small portion of the decrease in military spending, if any at all, is channelled to productive investment. Therefore, reducing military spending will not necessarily enhance economic growth. He further asserted that in LDCs, military spending would have a positive impact on growth via contributing to the civilian economy indirectly by enhancing accumulation of human capital. Additionally, military forces also engage in certain R&D and production activities that spill over to benefit the civilian sectors. Military spending can also affect economic growth positively through the expansion of aggregate demand (the Keynesian effect). The resulting increased demand leads to increased utilization of otherwise idle capital, higher employment and profits, and therefore higher investment.

One the other hand, causality can, as well, run on the opposite direction from economic growth to defence. In contrast to Benoit, Joerding (1986) claimed that a growing country may want to strengthen itself against foreign or domestic threats by increasing its military spending. Alternatively, a growing economy may choose to divert resources from the military sector to more productive sectors to further enhance growth.

Only a few studies have addressed the relationship between defence and economic growth for the Middle East economies, in general, and for the major rivals of the Israeli-

Arab conflict, in particular. Most of these studies implicitly assumed a causality running from defence spending to economic growth despite the fact that the opposite direction is theoretically plausible as well. The most common approaches to assess the defence growth relationship are the growth regressions and Granger causality tests.[1] The findings of the previous studies are inconclusive and vary depending on the countries examined, samples, and econometric methods.

Traditional Granger causality tests that gained popularity in the last two decades have been shown to have non-standard asymptotic properties if the variables are integrated or cointegrated. Moreover, the need for pre-tests for unit roots and cointegration and the inapplicability when the variables have different orders of integration further add to the distortions associated with Granger causality from within VAR or vector error correction (VEC) settings.

Unlike other studies that have used the traditional Granger causality test or causality from within a VEC, we utilize a causality procedure suggested by Toda and Yamamoto (1995) to examine the causal relationship between defence and economic growth. Their procedure requires the estimation of an augmented VAR that guarantees the asymptotic distribution of the Wald statistic. Also, the procedure does not require pre-testing for integration or cointegration properties of the VAR system, and thus avoids the potential biases of pre-testing. Our study takes into account the likely structural breaks in the series by testing for multiple breaks utilizing the Bai and Perron (2003) test. Moreover, we analyze the causal relationship between defence and growth after signing the peace treaty between Egypt and Israel in 1979 to assess whether a significant change in this relationship has occurred.

In addition to using the Toda and Yamamoto (1995), we examine the out-of-sample causality using the generalized forecast error variance decomposition method of Pesaran and Shin (1998). Unlike the traditional orthogonalized Cholesky method, this method does not require ordering of the variables in the VAR system, something that is often determined arbitrary given the absence of sound theoretical base.

The outline of this paper is as follows. The next section provides an overview of the literature dealing with the defence-growth nexus for Middle Eastern countries and it is followed by an exposition of the theoretical econometric foundations. The fourth section presents the data resources and definitions. Our results of the causality tests are presented in the fifth section and the last section concludes.

PREVIOUS STUDIES

As we mentioned earlier, only few studies have addressed the relationship between military expenditures and economic growth for the Middle Eastern countries, in general, and for the four rivals of the Israeli-Arab conflict, in particular. These studies provide mixed evidence, although the hypothesis of defence spending slowing economic performance is the dominant one.

In an early paper, Lebovic and Ishaq (1987) use a three-equation model employing panel data techniques for 20 Middle Eastern economies over the period 1973-1982. They find that military spending impedes economic growth for various groups of countries and for different alternative measures of military burden. These conclusions are shared by Linden (1992) who used an augmented two-sector growth model to study the effect of military burden on growth for a panel of 13 Middle East countries from 1973 to 1985 applying generalized least squares. Opposite findings are reported by Cohen and Ward (1996) who estimate a single equation model that relates growth to investments, military and non-military government spending, and population growth. They find that the benefits from military spending are large and affecting growth positively irrespective of the time period. Thus, they confirm the existence of a Keynesian effect that is roughly equivalent for both military and non-military government expenditures.

Mixed results were reported by DeRouen (1995) who examine the military expenditures of Israel, Egypt, Jordan, and Syria for the period 1953-88. He suggests that Egypt and Syria would realize the dividends from slashing their military spending only if they increase allocations to non-defence government spending. As to Israel, he asserts that defence cuts alone may actually deter growth in the short run. Furthermore, he finds that military spending had a negative effect on growth after 1967 coupled with positive military externalities on civilian output. Surprisingly, DeRouen (1995) finds that the defence sector in Jordan is very productive and therefore defence cuts would not lead to higher growth.

Diverting from the traditional practices, Abu-Bader and Abu-Qarn (2003) apply causality tests from within a VEC setting and Cholesky variance decomposition to uncover the direction of causality between defence and growth for Egypt, Israel, and Syria. They find that in a trivariate setting (government civilian expenditure, military spending, and growth) there is evidence for bidirectional causality and that military burden negatively affects economic growth for all countries whereas civilian government expenditures positively affect growth in Egypt and Israel.

A recent study by Yildirim et al. (2005) covering 13 Middle Eastern countries and applying dynamic panel data provides support for Benoit (1978). The authors find that military expenditures enhance economic growth in the Middle East.

Several studies have focused on the defence-growth nexus in Israel. Cohen et al. (1996) tackled the relationship by emphasizing the indirect linkages via investment and labour. They estimate a dynamic three-equation (investment, labour, and growth) model for the period 1960-1992 and conclude that the benefits for Israel from cutting military spending are small and positive, normally delayed for several years, and operate indirectly through investments. The indirect positive impact through investments was portrayed as well by Looney and Winterford (1995) for the period 1955-1987. They assert that they found no support for negative effect of high military burden on the Israeli economy mainly due to the American assistance. Evidence of non-linearity in the defence-growth relationship is reported by Bichler and Nitzan (1996). They claim that throughout the 1950s and most of the 1960s defence spending had a positive effect on growth through accumulation of human capital and smoother assimilation of new immigrants. However, since the late 1960, the large defence budgets led to higher debt and slower growth. DeRouen (2000) further analyzed the effects of military and no-military government spending on economic growth of Israel in a three-sector production function model for the years 1953-1992. His nonlinear least squares estimates suggest that when controlling for technological growth, short-term increases in defence spending hinder economic growth whereas non-defence spending have the opposite effect. Based on his findings, he recommends using saved resources from cutting military spending in the peace era for infrastructure and private investments.

ECONOMETRIC METHODOLOGIES

Economists often utilize vector autoregressions (VARs) to make inferences on causal relationships among endogenous variables. However Sims et al. (1990) and others have argued that, in general, the traditional Wald test for exact linear restrictions on the parameters in levels VAR does not have the usual asymptotic distributions if the variables are integrated or cointegrated. Proper inferences on VAR levels can be made only if all variables are known to be stationary. Otherwise, one can use VAR in differences if all variables are known to be integrated of order one but not cointegrated, and through the specification of a VEC model if all variables are *I(1)* and cointegrated. However, in most cases the order of integration and cointegration is not known a priori and pretesting for unit roots and cointegration is necessary before conducting causality tests. Consequently, the validity of causality tests is conditional on avoiding biases in testing for unit roots and cointegration among the variables. Econometric studies report that the pre-testing biases might be severe because the power of the unit root test is generally very low and tests for Johansen cointegration are not very reliable in finite samples.[2]

A recent procedure proposed by Toda and Yamamoto (1995) bypasses the need for potentially biased pre-tests for unit roots and cointegration, common to other formulations. The procedure utilizes the Wald test statistic for testing linear restrictions on the coefficients in an augmented VAR. The Modified WALD (MWALD) causality test has an asymptotic chi-squared distribution with p degrees of freedom in the limit when a VAR (p+d_{max}) is estimated, where p is the optimal lag order in the unrestricted levels VAR and d_{max} is the maximal order of integration of the variables in the VAR system. The causality procedure is implemented in two steps. In the first step, the correct order of the unrestricted level VAR (p) is to be determined using one of the information criteria methods, and d_{max} is to be determined using one of the unit root tests. The selected $VAR(p)$ is then augmented by the maximal order of integration and a VAR of order ($p + d_{\max}$) is estimated. Testing for causality in a bivariate system entails estimating the following augmented VAR of order ($p + d_{\max}$):

$$\begin{aligned} Y_{1t} &= \mu_1 + \sum_{k=1}^{p+d_{\max}} \beta_{11,k} Y_{1t-k} + \sum_{k=1}^{p+d_{\max}} \beta_{12,k} Y_{2t-k} + \varepsilon_{1t} \\ Y_{2t} &= \mu_2 + \sum_{k=1}^{p+d_{\max}} \beta_{21,k} Y_{1t-k} + \sum_{k=1}^{p+d_{\max}} \beta_{22,k} Y_{2t-k} + \varepsilon_{1t} \end{aligned} \qquad (1)$$

In the above setting, long-run Granger causality from variable Y_2 to variable Y_1 is evaluated by testing the null hypothesis that $\beta_{12,1} = ... = \beta_{12,p} = 0$, and causality from variable Y_1 to Y_2 is examined by testing the null hypothesis that $\beta_{21,1} = ... = \beta_{21,p} = 0$. Toda and Yamamoto

(1995) proved that the Wald statistic for testing the above null hypothesis converges in distribution to a χ^2_p random variable. The application of this procedure ensures that the usual test statistic for Granger causality has the standard asymptotic distribution and valid inference can be carried out.[3]

FEVD has been used repetitively by economists to examine the out-of-sample properties of the relationship between the variables in a VAR system. The method enables researchers to shed light not only on the direction but also on the intensity of the causal relationships between variables. Generally speaking, FEVD analysis decomposes the forecast error variance of a variable into proportions attributed to shocks in other variables, as well as its own. Most researchers have used the Cholesky decomposition that requires ordering of the variables. Without a sound theoretical base, ordering is arbitrary and the results may vary greatly depending on the ordering. As an alternative, Pesaran and Shin (1998) proposed a generalized FEVD that circumvent the need for ordering the variables and produce unique results by utilizing the contemporaneous correlations of the variables under investigation. Unlike the Cholesky decomposition, the generalized FEVD does not impose the restriction that the underlying shocks to the VAR are orthogonalized prior to decomposing the forecast error variances.

DATA DESCRIPTION AND SOURCES

Raw data were obtained from the following two main sources. (1) Real military expenditures in 2003 constant prices in US dollars as well as the share of military expenditures in GDP for the years 1988-2004 which were obtained from the SIPRI online database available at http://www.sipri.org. (2) Real military expenditures in 1993 constant prices in US dollars and the share of military expenditures in GNP for the period 1963-1987 which were obtained from a database compiled by Beenstock (1998). For the years 1960-1963 we derived the real GNP series using growth rates from the World

Development Indicators (WDI) online database (http://devdata.worldbank.org/dataonline), with the exception of Jordan for which the growth rates were taken from the PWT database available at http://pwt.econ.upenn.edu. Military expenditures were converted to real 2000 prices US dollars using the GDP deflator and the GNP/GDP ratio series from the WDI online database. The final product consists of military expenditures in US dollars at 2000 constant prices and the military burden proxied by the share of military expenditures in GDP.

In addition to the three Arab countries that constitute the major front line rivals of Israel, we constructed an aggregated Arab measure for the military expenditures, military burden and GDP. This measure is intended to assess the defence-growth nexus for the Arab bloc as whole.

RESULTS

In order to apply the Toda and Yamamoto (1995) we tested for the maximal order of integration of the variables in the VAR system using the Augmented Dickey-Fuller (ADF) unit root test. The results that are presented in Table 1 show that most of the series are integrated of order 1 with the exception of the GDP series of Egypt and the aggregated Arab GDP series. Thus, the maximal of integration (d_{max}) is one for Israel, Jordan, and Syria and Two for Egypt and Arab and the VAR systems would be augmented accordingly.

Our results of the Toda and Yamamoto (1998) causality tests are presented in Table 2. We conduct the test for two military measures; real military expenditures and military burden which is defined as the share of military expenditures in GDP. A quick look reveals the absence of any causal relationships between both military measures and growth. The only exception is a barely significant positive causality running from growth to military burden for Syria meaning that higher growth would lead to allocating higher portion of

GDP to military expenditures. Thus, in contrast to the widely documented negative impact of military expenditures on growth, we fail to detect any causality.

To further examine whether our results are driven by structural breaks in the series we conduct the Bai and Perron (2003) multiple structural breaks test for all series. The results, presented in Table 3, show the presence of varied significant structural breaks for the military and GDP series. Generally speaking, the breaks in the military series correspond to higher military expenditures in the late 1960s and the early 1970s, the period between the major wars of 1967 and 1973, and a drastic decline following the initiation of the peace talks between Egypt and Israel in the late 1970s. Incorporating structural breaks into out tests yields few changes to the results that omitted such breaks. The results that are presented in Table 4 show that when we take the real military expenditures as our defence measure we find a positive unidirectional causality running from military expenditures to economic growth for Syria (significant only at the 10% level) and for the Arab aggregate (significant at 5%). No causal relationships were detected for Egypt, Israel, and Jordan. In contrast to the widely documented adverse impact of military expenditures on economic growth, we find either weak positive impact or no causality.

The peace treaty between Egypt and Israel in 1979 marked a drastic change in the dynamics of the Israel-Arab conflict. Egypt, the largest and most dominant member of the Arab front against Israel ceased to play a major role in the conflict and even in the Arab and Muslim world. Additionally, the volume of military expenditures, not only of Egypt and Israel, but also Jordan and Syria dropped sharply. In order to assess whether this event has led to a change in the relationship under investigation, we conducted the same causality test for the four countries after 1979. Doing so, the number of observations per country dropped from 45 to 25 and the power of our tests is affected. Thus, we should examine the results carefully and bear in mind the low number of observations. Table 5 presents the results of the causality tests after 1979 and reveals a totally different picture of the nature of the defence-growth relationship with mixed evidence. We find several cases in which military spending impedes growth (Jordan, and Arab when taking real military spending and Jordan, Syria, and Arab for military burden), however, the negative impact is usually insignificant. We also detect that military spending of Egypt fosters growth although it is barely significant. The reversed direction of causality is present in our results as well. Increased output leads to a lower military spending for Syria but higher overall spending of the Arab countries. As we have stated, these results have to be interpreted cautiously due to the low power of the test and marginal significance of the sign of causality.

Another tool that can help us gauge the direction and strength, but not the sign, of the out-of-sample causality is the forecast error variance decomposition. The results of the Generalized FEVD are portrayed in Tables 6 and 7. These results clearly show that own shocks explain most of the forecast error variance of the variables while shocks to other variables only marginally help explain the forecast error variance. The results indicate the possibility of a weak bidirectional causality for Jordan and Syria when using the real military spending as the measure for defence since each variable explains about 11% of the forecast error variance of the other variable. Overall, the Generalized FEVD results verify the results of our Toda and Yamamoto (1995) causality tests; we find very weak or nonexistent causal relationship between the defence spending and economic growth.

SUMMARY AND CONCLUSIONS

This paper investigates the causal relationship between military spending and economic growth for the four rivals of the Israeli-Arab conflict over the 1960-2004 period utilizing a causality test developed by Toda and Yamamoto (1995) and the Generalized

FEVD suggested by Pesaran and Shin (1998). We conduct our analysis for two measures of military; real military spending and military burden.

Overall, we find weak or nonexistent causal relationship between defence and economic growth and fail to provide support for the conventional wisdom of adverse impact of military spending on economic growth. The causality analysis was conducted also with incorporating the likely structural breaks of the variables that were endogenously determined using the Bai and Perron (2003) multiple breaks test. However, our conclusions were not altered. Mixed results, mostly insignificant, were found when we addressed the post-1979 period, but due to the short time period one should expect the power of our causality tests to be relatively low. When examining the out-of-sample causality using the Generalized FEVD we found very weak causal relationship between defence and growth.

The lack of causal relationships between military spending and growth, in general, and the absence of adverse impact of military spending on the economic performance of the countries, in particular, cast serious doubts on the size of benefits that the involved countries would gain once they cut their military spending to internationally prevalent levels. Our results imply that these countries are not expected to harvest substantial dividends once a sustained peace has been achieved, however, one has to consider not only the pure economic costs/benefits of the conflict, but all the other aspects of life that would certainly improve and contribute to a more peaceful and productive environment.

Notes

[1] See Dunne et al., 2005 for a critical review of the models used to examine the defence-growth relationship.

[2] See Toda and Yamamoto (1995) and Pesaran et al. (2001).

[3] Zapata and Rambaldi (1997).

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Table 1 - ADF Unit Root Test

Real Military Expenditures

	Levels		**First differences**	
	ADF	**Lag**	**ADF**	**lag**
Egypt	-2.83	3	-5.09***	0
Israel	-1.96	0	-7.85***	0
Jordan	-2.38	0	-7.65***	0
Syria	-1.32	0	-5.04***	0
Arab	-2.41	2	-3.04**	1
Military Burden				
Egypt	-2.66	2	-3.03**	1
Israel	-1.83	0	-8.30***	0
Jordan	-2.33	0	-6.07***	1
Syria	-1.70	0	-7.96***	0
Arab	-2.71	2	-4.40***	0
GDP				
Egypt	-0.47	1	-2.40†	0
Israel	-1.03	0	-4.30***	0
Jordan	-1.85	2	-3.31**	2
Syria	-1.86	0	-6.77***	0
Arab	-0.14	0	-1.34†	1

Notes:

Optimal lag length based on SIC with 8 maximum lags allowed.
† The series is I(2).
*, **, *** denote significance at the 10%, 5%, 1%, respectively.

Table 2 – Toda and Yamamoto (1995) Causality Test†

Country	**Lag**	**MEX→Y**	**Y → MEX**
		Real Military Expenditures	
Egypt	1	0.44	0.003
Israel	1	0.01	0.36
Jordan	1	0.02	2.19
Syria	1	1.49	0.59
Arab	1	2.26	0.21
		Military Burden	
Egypt	2	0.79	0.34
Israel	1	0.04	0.20
Jordan	1	0.04	0.02
Syria	1	0.44	3.20*(+)*
Arab	1	0.07	0.71

Notes:
† F test.
→ indicates the direction of causality.
Optimal lags of the VAR are based on SIC with maximum 4 lags allowed.
*, **, *** denote significance at the 10%, 5%, 1%, respectively. The sign in parenthesis indicates the sign of causality.

Table 3 - Bai and Perron (2003) Test of Multiple Break Points

	Military Expenditures		Military Burden		GDP	
	Break 1	Break 2	Break 1	Break 2	Break 1	Break 2
Egypt	**1969**	**1977**	**1969**	**1977**	**1981**	**1995**
Israel	**1972**	**1982**	**1972**	**1986**	**1978**	**1993**
Jordan	**1975**	**1983**	**1981**	**1989**	**1979**	**1994**
Syria	**1974**	**1986**	**1967**	**1986**	**1975**	**1992**
Arab	**1968**	**1987**	**1969**	**1977**	**1975**	**1992**

Notes:

- Estimation with minimum 8 years between breakpoints.

Table 4 – Toda and Yamamoto (1995) Causality Test: With Structural Breaks†

Country	Lag	MEX→Y	Y → MEX
Real Military Expenditures			
Egypt	1	1.82	0.48
Israel	1	0.04	0.01
Jordan	1	0.59	0.38
Syria	2	4.57**(+)*	0.49
Arab	1	5.03**(+)**	0.35
Military Burden			
Egypt	2	1.23	1.93
Israel	1	2.14	1.88
Jordan	1	0.001	0.09
Syria	1	1.46	3.69*(+)*
Arab	1	2.41	0.88

Notes:

† F test.
→ indicates the direction of causality.
Optimal lags of the VAR are based on SIC with maximum 4 lags allowed.
*, **, *** denote significance at the 10%, 5%, 1%, respectively. The sign in parenthesis indicates the sign of causality.

Table 5 – Toda and Yamamoto (1995) Causality Test: After 1979†

Country	Lag	MEX→Y	Y → MEX
Real Military Expenditures			
Egypt	1	3.95*(+)*	1.19
Israel	1	0.06	0.37
Jordan	3	5.36***(-)	1.11
Syria	4	0.54	7.35***(-)*
Arab	2	5.80**(-)**	8.88***(+)**
Military Burden			
Egypt	2	0.41	2.85*(+)*
Israel	1	1.98	1.52
Jordan	2	6.53***(-)	0.87
Syria	2	3.48*(-)	0.27
Arab	3	4.60(-)	1.47

Notes:

† F test.
→ indicates the direction of causality.
Optimal lags of the VAR are based on SIC with maximum 4 lags allowed.
*, **, *** denote significance at the 10%, 5%, 1%, respectively. The sign in parenthesis indicates the sign of causality.

Table 6 – Generalized FEVD for Military Measure (%)

	Explained by own shock after … years				Explained by a shock to Y after … years			
	0	**1**	**5**	**10**	**0**	**1**	**5**	**10**
Real Military Expenditures								
Egypt	100	98.95	97.17	96.98	0.83	2.22	4.14	4.33
Israel	100	99.61	99.60	99.60	1.47	2.16	2.16	2.16
Jordan	100	98.85	98.82	98.82	11.15	10.86	10.92	10.92
Syria	100	99.47	99.47	99.47	10.11	11.52	11.55	11.55
Arab	100	99.59	96.41	94.32	0.53	1.11	4.73	6.90
Military Burden								
Egypt	100	9.45	98.01	97.83	1.15	2.22	3.95	4.14
Israel	100	99.92	99.92	99.92	5.41	5.80	5.79	5.79
Jordan	100	99.80	99.80	99.79	0.25	0.26	0.26	0.26
Syria	100	95.05	94.71	94.71	0.09	4.87	5.21	5.22
Arab	100	99.82	98.35	97.23	3.76	4.33	6.86	8.13

Table 7 – Generalized FEVD for Y (%)

	Explained by own shock after … years				Explained by a shock to military measure after … years			
	0	**1**	**5**	**10**	**0**	**1**	**5**	**10**
Real Military Expenditures								
Egypt	100	98.43	96.93	96.81	0.83	3.71	6.12	6.30
Israel	100	99.95	99.95	99.95	1.48	1.70	1.71	1.71
Jordan	100	99.95	99.95	99.95	11.15	10.75	10.73	10.73
Syria	100	97.58	97.56	97.56	10.11	11.47	11.52	11.52
Arab	100	96.24	94.18	94.06	0.53	3.54	7.39	7.92
Military Burden								
Egypt	100	99.08	97.56	97.41	1.15	3.25	5.87	6.11
Israel	100	99.95	99.95	99.95	5.41	5.12	5.11	5.11
Jordan	100	99.63	99.63	99.63	0.25	0.33	0.33	0.33
Syria	100	99.32	99.26	99.26	0.09	0.68	0.74	0.74
Arab	100	99.45	98.94	98.76	3.76	3.60	6.30	7.10